

WHAT IS CLAIMED IS:

- [c1] A method of compressing an intensity dynamic range of an input image to a reduced intensity dynamic range of an image display signal, said method comprising:
 - a) decomposing the input image into a plurality of image components;
 - b) modifying the intensity characteristics of the plurality of image components;
 - and
 - c) reconstructing the plurality of image components into an output image for display on an image display device.

- [c2] A method according to claim 1 wherein in step b), the intensity characteristics of each of said plurality of image components is modified separately.

- [c3] A method according to claim 1 wherein in step b), the modification of the intensity characteristics of said plurality of image components comprises mapping a plurality of intensities of an image component to a smaller plurality of intensities for said image component.

- [c4] A method according to claim 3 wherein said mapping is performed using a look-up table.

- [c5] A method according to claim 3 wherein said mapping is performed by calculating an intensity range for the image component based upon actual intensities of pixels within the image component.

- [c6] A method according to claim 1 wherein the decomposing of step a) and the reconstructing of step c) are performed using a Laplacian pyramid.

- [c7] A method according to claim 6 wherein step a) further comprises:
 - decimating said input image into a plurality of reduced images of successively smaller size;
 - interpolating said plurality of reduced images into a plurality of expanded images; and
 - generating at least one of said plurality of image components by subtracting one of said plurality of expanded images of a given size from one of said plurality of reduced images of said given size.

- [c8] A method according to claim 6 wherein step b) further comprises subjecting each of said plurality of image components to a separate one of a plurality of contrast functions to modify the intensity characteristics of each of said plurality of image components, wherein at least one of said plurality of contrast functions is different from other contrast functions in said plurality.
- [c9] A method according to claim 8 wherein said at least one contrast function is represented by the equation
- $$CF_M = G_M * (L'_N / L_N) * S_LUT(L_N, L_M)$$
- where N is lowest level number of the Laplacian pyramid, M is a level number of the Laplacian pyramid other than N, CF_M is the contrast function, G_M is a level gain, (L'_N / L_N) is a scaling function, L_N is an input intensity signal for the N-th level in the Laplacian pyramid, L'_N is an output intensity signal for the N-th level in the Laplacian pyramid, L_M is an input difference signal for the M-th level in the Laplacian pyramid and $S_LUT(L_N, L_M)$ is a transfer function depending on L_N and L_M .
- [c10] A method according to claim 6 wherein step c) further comprises combining said image components output from said plurality of contrast functions such that an image component having a smaller size is expanded to have a larger size before its combination with an image component having said larger size.
- [c11] A system for compressing an intensity dynamic range of an input image to a reduced intensity dynamic range of an image display signal, said system comprising:
- an image detector; and
 - a computer coupled to said image detector and configured to:
 - decompose the input image into a plurality of image components;
 - modify the intensity characteristics of the plurality of image components; and
 - reconstruct the plurality of image components into an output image for display on an image display device.
- [c12] A system according to claim 11 wherein said computer is further configured to separately modify the intensity characteristics of each of said plurality of image components.

- [c13] A system according to claim 11 wherein said computer is further configured to modify the intensity characteristics of said plurality of image components by mapping a plurality of intensities of an image component to a smaller plurality of intensities for said image component.
- [c14] A system according to claim 13 wherein said computer is further configured to perform said mapping using a look-up table.
- [c15] A system according to claim 13 wherein said computer is further configured to perform said mapping by calculating an intensity range for the image component based upon actual intensities of pixels within the image component.
- [c16] A system according to claim 11 wherein said computer is further configured to perform said decomposing step and said reconstructing step using a Laplacian pyramid.
- [c17] A system according to claim 16 wherein said computer is further configured to:
decimate said input image into a plurality of reduced images of successively smaller size;
interpolate said plurality of reduced images into a plurality of expanded images;
and
generate at least one of said plurality of image components by subtracting one of said plurality of expanded images of a given size from one of said plurality of reduced images of said given size.
- [c18] A system according to claim 16 wherein said computer is further configured to subject each of said plurality of image components to a separate one of a plurality of contrast functions to modify the intensity characteristics of each of said plurality of image components, wherein at least one of said plurality of contrast functions is different from other contrast functions in said plurality.
- [c19] A system according to claim 18 wherein said at least one contrast function is represented by the equation

$$CF_M = G_M * (L'_N / L_N) * S_LUT(L_N, L_M)$$
 where N is lowest level number of the Laplacian pyramid, M is a level number of the Laplacian pyramid other than N, CF_M is the contrast function, G_M is a level

gain, (L'_N / L_N) is a scaling function, L_N is an input intensity signal for the N-th level in the Laplacian pyramid, L'_N is an output intensity signal for the N-th level in the Laplacian pyramid, L_M is an input difference signal for the M-th level in the Laplacian pyramid and $S_LUT(L_N, L_M)$ is a transfer function depending on L_N and L_M .

- [c20] A system according to claim 16 wherein said computer is further configured to combine said image components output from said plurality of contrast functions such that an image component having a smaller size is expanded to have a larger size before its combination with an image component having said larger size.
- [c21] A computer readable medium having program code recorded thereon for compressing an intensity dynamic range of an input image to a reduced intensity dynamic range of an image display signal, said computer readable medium controlling a computer to perform the following method steps:
 a)decomposing the input image into a plurality of image components;
 b)modifying the intensity characteristics of the plurality of image components;
 and
 c)reconstructing the plurality of image components into an output image for display on an image display device.
- [c22] A computer readable medium according to claim 21 wherein in step b), the intensity characteristics of each of said plurality of image components is modified separately.
- [c23] A computer readable medium according to claim 21 wherein in step b), the modification of the intensity characteristics of said plurality of image components comprises mapping a plurality of intensities of an image component to a smaller plurality of intensities for said image component.
- [c24] A computer readable medium according to claim 23 wherein said mapping is performed using a look-up table.
- [c25] A computer readable medium according to claim 23 wherein said mapping is performed by calculating an intensity range for the image component based

upon actual intensities of pixels within the image component.

- [c26] A computer readable medium according to claim 21 wherein the decomposing of step a) and the reconstructing of step c) are performed using a Laplacian pyramid.
- [c27] A computer readable medium according to claim 26 wherein step a) further comprises:
decimating said input image into a plurality of reduced images of successively smaller size;
interpolating said plurality of reduced images into a plurality of expanded images; and
generating at least one of said plurality of image components by subtracting one of said plurality of expanded images of a given size from one of said plurality of reduced images of said given size.
- [c28] A computer readable medium according to claim 26 wherein step b) further comprises subjecting each of said plurality of image components to a separate one of a plurality of contrast functions to modify the intensity characteristics of each of said plurality of image components, wherein at least one of said plurality of contrast functions is different from other contrast functions in said plurality.
- [c29] A computer readable medium according to claim 28 wherein said at least one contrast function is represented by the equation

$$CF_M = G_M * (L'_N / L_N) * S_LUT(L_N, L_M)$$
 where N is lowest level number of the Laplacian pyramid, M is a level number of the Laplacian pyramid other than N, CF_M is the contrast function, G_M is a level gain, (L'_N / L_N) is a scaling function, L_N is an input intensity signal for the N-th level in the Laplacian pyramid, L'_N is an output intensity signal for the N-th level in the Laplacian pyramid, L_M is an input difference signal for the M-th level in the Laplacian pyramid and $S_LUT(L_N, L_M)$ is a transfer function depending on L_N and L_M .
- [c30] A computer readable medium according to claim 26 wherein step c) further

comprises combining said image components output from said plurality of contrast functions such that an image component having a smaller size is expanded to have a larger size before its combination with an image component having said larger size.